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TITLE: Fuel assembly increase arranging number of lattice - comprises spring fitted to right or left side opening on elastic folded plate

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ABSTRACTED-PUB-NO: JP 07035883A

BASIC-ABSTRACT:

In a fuel assembly a spring can be fitted to the right or left side opening which is on an elastic **folded** plate welded on round **cells in which fuel** elements are inserted.

USE/ADVANTAGE - Increase of the arranging number in fuel element lattice.

CHOSEN-DRAWING: Dwg.1/10

TITLE-TERMS: FUEL ASSEMBLE INCREASE ARRANGE NUMBER LATTICE COMPRISE SPRING FIT RIGHT LEFT SIDE OPEN ELASTIC FOLD PLATE

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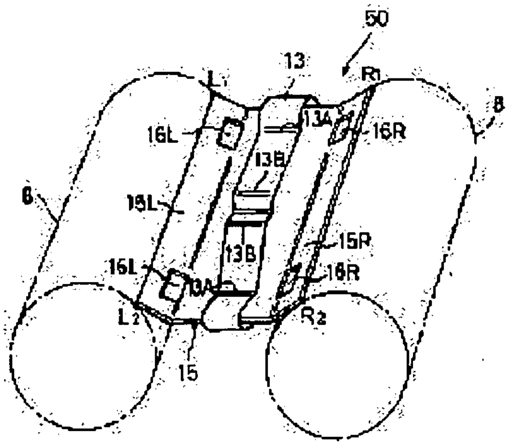
(54) FUEL ASSEMBLY

(57)Abstract:
PURPOSE: To provide a fuel assembly in which generation of eutectic is suppressed without splitting the plate while allowing highly accurate bending work and high degree of burn-up is realized by increasing the number of fuel element grids.
CONSTITUTION: A resilient supporting plate 15 has right and left bent side faces 15R, 15L which are spot welded at the edges thereof, i.e., welding points L1, L2 or R1, R2, to a round cell 8. Each of the bent side faces 15R, 15L is provided with two openings 16R, 16L at substantially same height as the plate contact part 13A of a spring member 13. Consequently, the plate contact part 13A is inserted, at the end thereof, into the opening 16L when the spring member 13 is shifted to the left and into the opening 16R when the spring member 13 is shifted to the right.



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CLAIMS

[Claim(s)]
[Claim 1] Two or more body material in which is equipped with the fuel spacer holding mutual spacing of two or more fuel elements, at least one water rod, and these fuel elements and a water rod, and said fuel element is inserted for said fuel spacer, respectively, At least one fixed buttress plate which connects with said body material, and is contacted and supported to said water rod, In the fuel assembly which has the loop-formation-like spring member which supports said water rod elastically, and at least one elastic support plate with which it connected with said body material, and had said loop-formation-like spring member The 1st flection which said loop-formation-like spring member is located near the ends of this loop-formation-like spring member, contacts said fixed buttress plate, and serves as the supporting point of a spring, It has the 2nd flection which is located near the center of this loop-formation-like spring member, contacts said elastic support plate, and serves as a power point of a spring. And said elastic support plate It has the folding side face of two right and left which are formed of folding and fixed to said body material. Between the two folding side faces at least one side The fuel assembly characterized by being missing near the location where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate at least.
[Claim 2] Two or more body material in which is equipped with the fuel spacer holding mutual spacing of two or more fuel elements, at least one water rod, and these fuel elements and a water rod, and said fuel element is inserted for said fuel spacer, respectively, At least one fixed buttress plate which connects with said body material, and is contacted and supported to said water rod, In the fuel assembly which has the loop-formation-like spring member which supports said water rod elastically, and at least one elastic support plate with which it connected with said body material, and had said loop-formation-like spring member The 1st flection which said loop-formation-like spring member is located near the ends of this loop-formation-like spring member, contacts said fixed buttress plate, and serves as the supporting point of a spring, It has the 2nd flection which is located near the center of this loop-formation-like spring member, contacts said elastic support plate, and serves as a power point of a spring. And said elastic support plate It has the folding side face of two right and left which are formed of folding and fixed to said body material. The two folding side faces The fuel assembly characterized by being missing near the location where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate at least.
[Claim 3] It is the fuel assembly characterized by preparing opening in the location where said 1st flection contacts when said folding side face moves said loop-formation-like spring member horizontally along with a plate in a fuel assembly according to claim 1 or 2.
[Claim 4] It is the fuel assembly characterized by having the two notching sections formed by said folding side face's cutting the contact location of two places where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate, and lacking in a fuel assembly according to claim 1 or 2.
[Claim 5] It is the fuel assembly characterized by having the one notching section formed by said folding side face's cutting the field across which it faced in the contact location where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate and the contact location of two places of two places, and lacking in a fuel assembly according to claim 1 or 2.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the fuel assembly especially equipped with the round-head cel mold fuel spacer with respect to the fuel assembly arranged at a reactor reactor core.
[0002]
[Description of the Prior Art] The fuel spacer of the fuel assembly of a reactor has the role restrained so that these may not vibrate in a longitudinal direction while holding a fuel element and a water rod at predetermined spacing. The structure of the fuel spacer in the conventional technique has some which are shown in JP,58-200194,A. That is, it has the plate with a spring equipped with the plate holding the cel stop where a fuel spacer is formed in a part of two or more round-head cel which form the independent unit cell and support a fuel element, and round-head cel, and serves as a fixed supporting point of a fuel element, the spring material which is in a round-head cel and supports a fuel element elastically, the spring material which supports a water rod elastically, and spring material.
[0003] Spring material is loop-formation-like structure, is prepared in the center of spring material and has the water rod press section which presses and supports a water rod, and the plate contact section which is prepared in the edge approach of spring material, contacts a plate, and acts as the supporting point. Having the folding side face of two right and left which the plate was bent and were formed, these folding side face is structure fixed to a round-head cel by spot welding etc. in two welding points of an edge, respectively.
[0004] In the procedure which manufactures this plate with a spring, it considers as the plate blank which bent the end of a plate raw material and formed only folding side face of one of the two first, and then spring material is inserted in a plate blank. Then, the remaining ends of a plate blank are bent, it considers as a plate, and a plate with a spring is completed.
[0005]
[Problem(s) to be Solved by the Invention] In recent years, high burnup-ization of a fuel is advanced from viewpoints, such as deployment [of the extension and uranium resources of an operating period] -, and also reduction of a spent fuel yield. When attaining this high burnup-ization, make the outer diameter of a fuel element thin and increase the number of lattices of a fuel element 2. (For example, the array of a fuel element is increased in 9x9, 10x10, and 11x11 grade from 8x8 conventional arrays) By knowing that things are advantageous and increasing the number of lattices of a fuel element in this way Since linear heat rating is decreased and heat transfer area can be increased, the thermal allowances of a fuel element can be made to increase.
[0006] However, in the above-mentioned conventional technique, when attaining high burnup-ization of a fuel by making the number of lattices of a fuel element increase, the following technical problems exist. That is, if it takes into consideration that it is desirable to give a present reactor core and versatility even when making the number of lattices of a fuel element increase, it is necessary to make ** etc. the same as the former outside a fuel assembly, and, therefore, spacing between fuel elements will become narrow inevitably with the increment in the number of lattices of a fuel element. If spacing between fuel elements becomes narrow, the width of face of the plate flat part between two folding side faces of a plate with a spring will become narrow. Therefore, in a fabrication of a plate with a spring, in case the other end of a plate blank is bent and a folding side face is formed after inserting spring material in a plate blank, spacing of a folding fixture and spring material cannot be taken enough, but the folding itself becomes difficult. moreover, since the thing for which bending was possible

and which precision improves for bending is not temporarily expectable even if it carries out, it cannot use, and high combustion-ization of a fuel cannot be attained by the increment in the number of arrays of a fuel element after all.
[0007] After forming a folding side face as an approach of solving such a technical problem where a plate raw material is beforehand divided into two in the die-length direction, considering as two small plates and letting spring material pass, it is possible that welding etc. ties these two and they are united. In this case, a small plate can pass now through the inside of the loop formation of spring material by considering as a small plate with short die length. However, according to this approach, the technical problem that it is difficult to make whenever [profile] into about the same precision as a plank when two small plates are connected by welding etc., and dispersion in the presser-foot force of the water rod obtained by spring material becomes large arises.
[0008] Moreover, on the other hand, when spacing between fuel elements becomes narrow, the following technical problems are also produced. That is, after a plate with a spring is completed, in the welding point of two each of the folding side face of two right and left, spot welding of the plate with a spring is carried out to a round-head cel, it is fixed to it, but if spacing between fuel elements becomes narrow and the width of face of a plate with a spring becomes narrow, the distance between spring material and a welding point will decrease. Therefore, spring material becomes easy to be influenced by heat conduction of the welding heat in the case of welding, an eutectic may be produced in dissimilar metals (for example, when a plate and a round-head cel are zirconium alloys and spring material is a nickel radical alloy etc.), and it is not desirable on corrosion resistance and other material properties.
[0009] The object of this invention is offering the fuel assembly which performs bending with a sufficient precision, reducing and preventing generating of an eutectic without dividing a plate, increases the number of lattices of a fuel element, and can attain high burnup-ization of a fuel.
[0010]
[Means for Solving the Problem] In order to attain the above-mentioned object, according to this invention, two or more fuel elements and at least one water rod, Two or more body material in which is equipped with the fuel spacer holding mutual spacing of these fuel elements and a water rod, and said fuel element is inserted for said fuel spacer, respectively, At least one fixed buttress plate which connects with said body material, and is contacted and supported to said water rod, In the fuel assembly which has the loop-formation-like spring member which supports said water rod elastically, and at least one elastic support plate with which it connected with said body material, and had said loop-formation-like spring member The 1st flection which said loop-formation-like spring member is located near the ends of this loop-formation-like spring member, contacts said fixed buttress plate, and serves as the supporting point of a spring, It has the 2nd flection which is located near the center of this loop-formation-like spring member, contacts said elastic support plate, and serves as a power point of a spring. And said elastic support plate It has the folding side face of two right and left which are formed of folding and fixed to said body material. Between the two folding side faces at least one side When moving said loop-formation-like spring member horizontally along with a plate at least, the fuel assembly characterized by being missing near the location where said 1st flection contacts is offered.
[0011] In order to attain the above-mentioned object, according to this invention, moreover, two or more fuel elements, Two or more body material in which is equipped with the fuel spacer holding mutual spacing of at least one water rod, and these fuel elements and a water rod, and said fuel element is inserted for said fuel spacer, respectively, At least one fixed buttress plate which connects with said body material, and is contacted and supported to said water rod, In the fuel assembly which has the loop-formation-like spring member which supports said water rod elastically, and at least one elastic support plate with which it connected with said body material, and had said loop-formation-like spring member The 1st flection which said loop-formation-like spring member is located near the ends of this loop-formation-like spring member, contacts said fixed buttress plate, and serves as the supporting point of a spring, It has the 2nd flection which is located near the center of this loop-formation-like spring member, contacts said elastic support plate, and serves as a power point of a spring. And said elastic support plate It has the folding side face of two right and left which are formed of folding and fixed to said body material. The two folding side faces When moving said loop-formation-like spring member horizontally along with a plate at least, the fuel assembly characterized by being missing near the location where said 1st flection contacts is offered.
[0012] Preferably, in said fuel assembly, the fuel assembly characterized by said folding side face preparing

opening in the location where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate is offered.

[0013] Moreover, preferably, in said fuel assembly, said folding side face cuts the contact location of two places where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate, and the fuel assembly characterized by having the two notching sections formed by lacking is offered.

[0014] The fuel assembly characterized by having the one notching section formed by said folding side face's cutting the field across which it faced in the contact location where said 1st flection contacts when moving said loop-formation-like spring member horizontally along with a plate and the contact location of two places of two places, and lacking in said fuel assembly still more preferably is offered.

[0015]

[Function] When missing near [where the 1st flection contacts in this invention constituted as mentioned above when moving a spring member horizontally along with a plate in the folding side face of an elastic support plate] the location the time of bending the folding side face of another side and completing an elastic support plate, after inserting a spring member for one folding side face in the state of bending wooden clogs -- the 1st flection of a spring member -- this deficit section -- inserting -- already -- bending wooden-clogs one folding side-face side -- a spring -- the maximum ****** -- things are made. Therefore, when bending the folding side face of another side which remained, the tooth space in which the fixture for bendings is installed can be secured more widely, and a folding side face can be processed with a sufficient precision.

[0016] Moreover, although it fixes by welding two folding side faces of an elastic support plate to body material in case the completed elastic support plate is fixed to body material By welding to the folding side face and opposite hand which are going to weld to the above-mentioned deficit section by inserting the 1st flection of a spring member at the time of this welding by detaching the distance from the maximum ****** welding location, it prevents that an eutectic is generated with heating by heat conduction. When preparing a deficit in both two folding side faces at this time, generating of an eutectic can be mutually prevented using the deficit of the folding side face of an opposite hand, when preparing a deficit only in one folding side face, generating of an eutectic can be prevented only about the folding side face of that opposite hand, and generating of an eutectic can be reduced as the whole.

[0017] There are a configuration which prepares opening in a folding side face and is considered as a deficit as an approach of preparing this deficit, and a configuration which cuts and lacks a part of folding side face, and forms a deficit.

[0018]

[Example] Hereafter, drawing 1 - drawing 10 explain the example of this invention. Drawing 1 - drawing 7 explain the 1st example of this invention. The whole fuel assembly structural drawing of this example is shown in drawing 2 . In drawing 2 , a fuel assembly 1 is the structure where have the up stay plate 5 and the lower stay plate 6 which support the vertical edge of the fuel spacer 4 which bundles two or more fuel element 2 and one water rod 3, and fuel elements 2 and the water rods 3 in the shape of a tetragonal lattice, and the fuel element 2 and the water rod 3, and these were covered with the rectangular pipe-like channel box 7. At this time, the fuel spacer 4 has the role restrained so that these may not vibrate in a longitudinal direction while holding a fuel element 2 and the water rod 3 at predetermined level spacing.

[0019] The structure of the fuel spacer 4 is shown in drawing 3 . Two or more round-head cels 8 which the fuel spacer 4 forms the independent unit cell, and support a fuel element 2, Cel stop 8A which is formed in a part of round-head cel 8, and becomes the fixed supporting point of a fuel element 2, The plate 50 with a spring equipped with the elastic support plate 15 holding the spring material 11 which is in the round-head cel 8 and supports a fuel element 2 elastically, the spring material 13 which supports the water rod 3 elastically, and the spring material 13, It has the fixed buttress plate 10 which acts as a fixed supporting point of the water rod 3, and forms the cel for water rod 3 arrangement with the plate 50 with a spring, and the band 9 which serves as an outer frame for forming the fuel spacer 4 in a bundle in the shape of a tetragonal lattice in two or more round-head cels 8.

[0020] Generally the round-head cel 8, the elastic support plate 15, the fixed buttress plate 10, and band 9 grade are constituted by the zirconium alloy with a small neutron absorption cross section. Moreover, on the other hand, the spring material 11 and the spring material 13 are constituted by the heat-resistant anticorrosion superalloy (Inconel) which is a nickel radical alloy.

[0021] Moreover, the water rod 3 is supported with the spring material 13 and the fixed buttress plate 10 with which the plate 50 with a spring was equipped. The detail structure of the spring material 13 neighborhoods is shown in drawing 4 . In drawing 4 , the spring material 13 of the plate 50 with a spring presses and supports the water rod 3, and the elastic support plate 15 of the plate 50 with a spring is being welded and fixed to the round-head cel 8 in the edge of the folding side faces 15L and 15R (after-mentioned) on either side, respectively.
[0022] The structure of the plate 50 with a spring is shown in drawing 1 and drawing 5 . The perspective view in which drawing 1 shows the whole plate 50 structure with a spring, and drawing 5 are the side elevations of a plate with a spring. In drawing 1 and drawing 5 , the plate 50 with a spring has the spring material 13 which carries out elastic support of the water rod 3, and the elastic support plate 15. The spring material 13 is loop-formation-like structure, is prepared in the center of the spring material 13, and has the water rod press sections 13B and 13B which press and support the water rod 3, and the plate contact sections 13A and 13A which are prepared in the edge approach of the spring material 13, contact the elastic support plate 15, and act as the supporting point.
[0023] The elastic support plate 15 has the folding side faces 15L and 15R of the right and left formed of folding, and these folding side-face 15L and R are structures fixed to the round-head cel 8 by spot welding in the welding points L1 and L2 which are edges, or R1 and R2, respectively. Moreover, when horizontal right and left are made to move the spring material 13 to the folding side faces 15L and 15R of the elastic support plate 15 along with a plate, every two openings 16L and 16L, and 16R and 16R are prepared in the location where the plate contact sections 13A and 13A contact, respectively. That is, if the spring material 13 is moved to horizontal left-hand side along with a plate, when the edge of the plate contact sections 13A and 13A moves Openings 16L and 16L to horizontal right-hand side along with a plate, it will be inserted in Openings 16R and 16R, respectively (refer to drawing 5).
[0024] Drawing 6 explains the procedure which manufactures the plate 50 with a spring of the above-mentioned configuration. Since the gap of plate contact section 13A of the spring material 13 is narrow, after the plate 50 with a spring bends beforehand two folding side-face 15L and R and forms the elastic support plate 15, it is difficult the plate to insert the spring material 13 in the elastic support plate 15. Therefore, it considers as the plate blank 14 which first bent the end of the plate raw material (not shown) which formed four openings 16L, 16L, 16R, and 16R, and formed only folding side-face 15L, and then the spring material 13 is inserted in the plate blank 14 (drawing 6 (a)). Then, it considers as the elastic support plate 15 which bent the remaining ends of the plate blank 14 and formed folding side-face 15R, and the plate 50 with a spring is completed (drawing 6 (b)).
[0025] Next, drawing 7 explains an operation of this example. In recent years, high burnup-ization of a fuel is advanced from viewpoints, such as deployment [of the extension and uranium resources of an operating period] -, and also reduction of a spent fuel yield. When attaining this high burnup-ization, make the outer diameter of a fuel element 2 thin, and increase the number of lattices of a fuel element 2. (For example, the array of a fuel element 2 is increased in 9x9, 10x10, and 11x11 grade from 8x8 conventional arrays) By knowing that things are advantageous and increasing the number of lattices of a fuel element 2 in this way Since linear heat rating is decreased and heat transfer area can be increased, the thermal allowances of a fuel element 2 can be made to increase. However, if it takes into consideration that it is desirable to give a present reactor core and versatility, it is necessary to make ** etc. the same as the former outside a fuel assembly 1, and, therefore, spacing between fuel elements 2 will become narrow inevitably with the increment in the number of lattices of a fuel element 2.
[0026] If spacing between fuel elements 2 becomes narrow, the width of face of plate flat part 15C between the folding side faces 15L and 15R of the plate 50 with a spring shown in drawing 6 (b) will become narrow. Therefore, in a fabrication of the plate 50 with a spring mentioned above, in case the other end of the plate blank 14 is bent and folding side-face 15R is formed after inserting the spring material 13 in the plate blank 14, spacing of a folding fixture and the spring material 13 cannot be taken enough, but the folding itself becomes difficult. moreover, since the thing for which bending was possible and which precision improves for bending is not temporarily expectable even if it carries out, it cannot use, and high combustion-ization of a fuel cannot be attained by the increment in the number of arrays of a fuel element after all.
[0027] Moreover, after the plate 50 with a spring is completed with the procedure shown in drawing 6 (a) and (b), as shown in drawing 1 , in folding side-face 15L of right and left, and the welding points L1 and L2 (or R1,

R2) of R, spot welding of the plate 50 with a spring is carried out to the round-head cel 8, and it is fixed to it. However, if spacing between fuel elements 2 becomes narrow as mentioned above and the width of face of the plate 50 with a spring becomes narrow at this time, the distance between the spring material 13 and the welding points L1 and L2 (or R1, R2) will decrease. Therefore, the spring material 13 becomes easy to be influenced by heat conduction of the welding heat in the case of welding, an eutectic may be produced in dissimilar metals (the elastic support plate 15 and the round-head cel 8 are zirconium alloys, and the spring material 13 is a nickel radical alloy), and it is not desirable on corrosion resistance and other material properties.

[0028] However, in this example, the above-mentioned technical problem is solved by forming Openings 16L, 16L, 16R, and 16R in the plate blank 14. Hereafter, drawing 7 explains this to a detail. In order to leave the tooth space to which the folding fixture which drawing 7 is drawing showing the condition of the spring member in the procedure which bends the remaining ends of a plate blank described previously, namely, bends the right-hand side of a plate blank is applied, the spring member expresses the condition that the maximum migration was carried out to left-hand side. Drawing 7 (a) expresses this example and the case of the conventional technique in which drawing 7 (b) does not prepare opening is expressed (although the part number is distinguished as the base of No. 100, the configuration is the same as that of drawing 7 (a) almost).

[0029] In drawing 7 (a) and (b), the dimension which can bring near the spring material 13 by the folding side-face 15L side is restricted by interference with narrowest plate contact section 13A of a gap, and folding side-face 15L in the spring material 13. the conventional technical example which eases this limit and shows the spring material 13 to drawing 7 (b) by forming Openings 16L and 16L in that location in which it interferes, and inserting the edge of plate contact section 13A of the spring material 13 in this example shown in drawing 7 (a) -- comparing -- the folding side-face 15L side (left-hand side in drawing) -- the maximum ****** -- things are made. Therefore, the tooth space in which the fixture for bendings at the time of forming folding side-face 15R which remained is installed can be secured more widely, and folding side-face 15R can be processed with a sufficient precision.

[0030] Moreover, when carrying out spot welding of the completed plate 50 with a spring to the round-head cel 8, When it is going to weld in the welding points L1 and L2 (refer to drawing 1), the spring member 13 is welded to the folding side-face 15R side by detaching the distance from the maximum ****** welding location using Openings 16R and 16R. When it is going to weld in the welding points R1 and R2 (refer to drawing 1), the spring member 13 using Openings 16L and 16L moreover, by welding to the folding side-face 15L side by detaching the distance from the maximum ****** welding location A large distance of the spring material 13 and the welding points R1, R2, L1, and L2 can be taken as much as possible, and it can prevent that an eutectic is generated with heating by heat conduction.

[0031] Since Openings 16L and 16L are formed in folding side-face 15L of the elastic support plate 15 according to this example as explained above In case the remaining folding side-face 15R is bent and the elastic support plate 15 is completed after inserting the spring material 13, where folding side-face 15L is bent the edge of the plate contact sections 13A and 13A of the spring material 13 -- these openings 16L and 16L -- inserting -- already -- the bending wooden-clogs folding side-face 15L side -- the spring material 13 -- the maximum ****** -- things are made. Therefore, when bending folding side-face 15R which remained, the tooth space in which the fixture for bendings is installed can be secured more widely, and folding side-face 15R can be processed with a sufficient precision. Therefore, bending is performed with a sufficient precision, the number of lattices of a fuel element is increased, without dividing a plate, and the fuel assembly which attains high burnup-ization of a fuel can be realized.

[0032] Moreover, although it fixes by welding two folding side faces 15L and 15R of the elastic support plate 15 to the round-head cel 8 in case the completed plate 50 with a spring is fixed to the round-head cel 8 At the time of welding of folding side-face 15L, the plate contact sections 13A and 13A of the spring material 13 are inserted in the openings 16R and 16R of folding side-face 15R. To the folding side-face 15R side The maximum ****, the time of welding of folding side-face 15R -- the plate contact sections 13A and 13A of the spring material 13 -- the openings 16L and 16L of folding side-face 15L -- inserting -- the folding side-face 15L side -- the maximum ******, since it welds by detaching the distance from a welding location by things It can prevent that an eutectic is generated with heating by heat conduction.

[0033] Drawing 8 explains the 2nd example of this invention. The fuel assembly of this example is an example from which the configuration of the plate with a spring of a fuel spacer differs. The plate with a spring in the fuel assembly of this example is shown in drawing 8 . A common number shows the 1st example and common components. In drawing 8 , the point that the plate 60 with a spring of this example differs from the plate 50 with a spring of the 1st example is a point of forming Openings 66L and 66L only in folding side-face 65L [on the other hand / (left-hand side in drawing)], and having not prepared opening in folding side-face 65R of another side (drawing Nakamigi side). Other points are the same as that of the plate 50 with a spring of the 1st example almost.

[0034] the time of forming folding side-face 65R like the 1st example at the time of a fabrication of the plate 60 with a spring according to this example -- the edge of plate contact section 13A of the spring material 13 -- Openings 66L and 66L -- inserting -- the spring material 13 -- the folding side-face 65L side (left-hand side in drawing) -- the maximum ****** -- folding side-face 65R is processible with a sufficient precision with things. Therefore, bending is performed with a sufficient precision, the number of lattices of a fuel element is increased, without dividing a plate, and the fuel assembly which attains high burnup-ization of a fuel can be realized.

[0035] Moreover, in case spot welding of the plate 60 with a spring is carried out to the round-head cel 8, generating of an eutectic can be prevented by welding only about welding of folding side-face 65R by inserting the edge of plate contact section 13A of the spring material 13 in Openings 66L and 66L, and bringing near the spring member 13 by the folding side-face 65L side. That is, although this effectiveness does not exist about welding of folding side-face 65L, generating of an eutectic can be reduced if it sees from the whole folding side face. Drawing 9 explains the 3rd example of this invention. The fuel assembly of this example is an example from which the configuration of the plate with a spring of a fuel spacer differs. The plate with a spring in the fuel assembly of this example is shown in drawing 9 . A common number shows the 1st and 2nd examples and common components. In drawing 9 , the point that the plate 70 with a spring of this example differs from the plate 50 with a spring of the 1st example Instead of the openings 16L and 16L in the 1st example, and 16R and 16R on two folding side faces 75L and 75R of the plate 70 with a spring Every two notching sections 77L and 77L, and 77R and 77R are prepared, respectively, and the folding side faces 75L and 75R consist of three tongue 75La, 75Lb, 75Lc and 75Ra, 75Rb, and 75Rc, respectively. About other points, it is the same as that of the 1st example almost.

[0036] The same effectiveness as the 1st example is acquired by this example. namely, the time of forming tongue 75Ra of folding side-face 75R by the side of drawing Nakamigi, 75Rb, and 75Rc -- the edge of plate contact section 13A of the spring material 13 -- the notching sections 77L and 77L of folding side-face 75L -- inserting -- the spring material 13 -- the folding side-face 75L side (left-hand side in drawing) -- the maximum ****** -- folding side-face 75R is processible with a sufficient precision with things. Therefore, bending is performed with a sufficient precision, the number of lattices of a fuel element is increased, without dividing a plate, and the fuel assembly which attains high burnup-ization of a fuel can be realized.

[0037] Moreover, similarly, in case spot welding of the plate 70 with a spring is carried out to the round-head cel 8, generating of an eutectic can be prevented by inserting the edge of plate contact section 13A of the spring material 13 in the notching sections 77L and 77L of folding side-face 75L, or the notching sections 77R and 77R of folding side-face 75R, and welding by bringing near the spring member 13 by the folding side-face 75L or folding side-face 75R side, respectively.

[0038] Drawing 10 explains the 4th example of this invention. The fuel assembly of this example is an example from which the configuration of the plate with a spring of a fuel spacer differs. The plate with a spring in the fuel assembly of this example is shown in drawing 10 . A common number shows the 1st - the 3rd example, and common components. In drawing 10 , the point that the plate 80 with a spring of this example differs from the plate 70 with a spring of the 3rd example Middle tongue 75Lb and 75Rb are removed among tongue 75La, 75Lb, 75Lc and 75Ra of three each which constitutes the folding side face of right-and-left both sides, 75Rb, and 75Rc. When moving the spring material 13 horizontally along with a plate, it has the notching sections 88L and 88R which cut all the fields across which it faced in the contact location where the plate contact sections 13A and 13A contact and contact location of two places, and were formed by lacking. That is, two folding side faces 85L and 85R consist of only tongue 85La formed in near where spot welding is performed, 85Lb and 85Ra, and 85Rc. About other points, it is the same as that of the 3rd example almost. The same effectiveness as the 3rd example is acquired by this example.

[0039] In addition, there is also a configuration which cuts deeply only on the left-hand side in drawing, i.e., the

3rd example, like the 2nd example previously shown although slitting was prepared in right-and-left-among drawing both sides by each in the 3rd and 4th examples of the above, cuts only 77L and 77L deeply in the 4th example, and is set only to 88L and which does things, and the effectiveness same in this case as the 2nd example is acquired.
[0040] Moreover, in above-mentioned drawing 1 and the plate with a spring of the 1st - the 4th example shown in 8, 9, and 10, each acquires the same effectiveness, even if right-and-left reverse is sufficient as this sequence and it attaches the spring member 13 to it in this case, although the folding side face of the right-hand side in drawing was bent in the plate blank which processed previously the folding side face of the left-hand side in drawing through and after that.
[0041]
[Effect of the Invention] Since according to this invention it is missing near [where the 1st flection contacts] the location when moving a spring member horizontally along with a plate in the folding side face of an elastic support plate the time of bending the folding side face of another side and completing an elastic support plate, after inserting a spring member for one folding side face in the state of bending wooden clogs -- the 1st flection of a spring member -- this deficit section -- inserting -- already -- bending wooden-clogs one folding side-face side -- a spring -- the maximum ****** -- things are made. Therefore, when bending the folding side face of another side which remained, the tooth space in which the fixture for bendings is installed can be secured more widely, and a folding side face can be processed with a sufficient precision. Therefore, bending is performed with a sufficient precision, the number of lattices of a fuel element is increased, without dividing a plate, and the fuel assembly which attains high burnup-ization of a fuel can be realized.
[0042] Moreover, in case the completed elastic-support plate is fixed to body material, it fixes by welding two folding side faces of an elastic support plate to body material, but since it welds to the folding side face and the opposite hand which are going to weld to the above-mentioned deficit section by inserting the 1st flection of a spring member at the time of this welding by detaching the distance from the maximum ****** welding location, it prevents that an eutectic is generated with heating by heat conduction. When preparing a deficit in both two folding side faces at this time, generating of an eutectic can be mutually prevented using the deficit of the folding side face of an opposite hand, when preparing a deficit only in one folding side face, generating of an eutectic can be prevented only about the folding side face of that opposite hand, and generating of an eutectic can be reduced as the whole.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the whole plate structural drawing with a spring of the 1st example of this invention.
[Drawing 2] It is the whole fuel assembly structural drawing.
[Drawing 3] It is structural drawing of a fuel spacer.
[Drawing 4] It is detail structural drawing near spring material.
[Drawing 5] It is the side elevation of a plate with a spring.
[Drawing 6] It is drawing showing the procedure which manufactures a plate with a spring.
[Drawing 7] It is drawing showing the condition of the spring member in the procedure which bends a plate blank.
[Drawing 8] It is structural drawing of the plate with a spring of the 2nd example of this invention.
[Drawing 9] It is structural drawing of the plate with a spring of the 3rd example of this invention.
[Drawing 10] It is structural drawing of the plate with a spring of the 4th example of this invention.
[Description of Notations]
1 Fuel Assembly
2 Fuel Element
3 Water Rod
4 Fuel Spacer
8 Round-Head Cel
10 Fixed Buttress Plate
13 Spring Material
13A Plate contact section
13B Water rod press section
15 Elastic Support Plate
15L, 15R Folding side face
16L, 16R Opening
65 Elastic Support Plate
65L, 65R Folding side face
66L Opening
75 Elastic Support Plate
75L, 75R Folding side face
77L, 77R Notch
85 Elastic Support Plate
85L, 85R Folding side face
88L, 88R Notch

[Translation done.]

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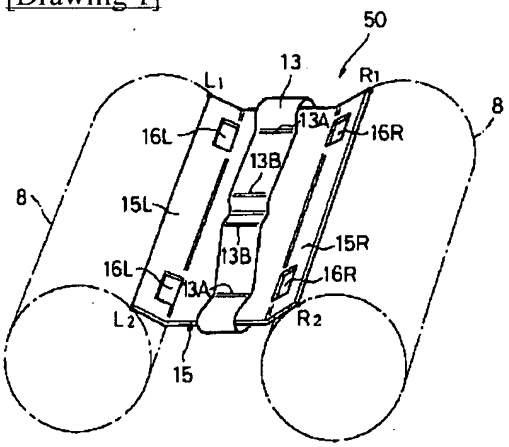
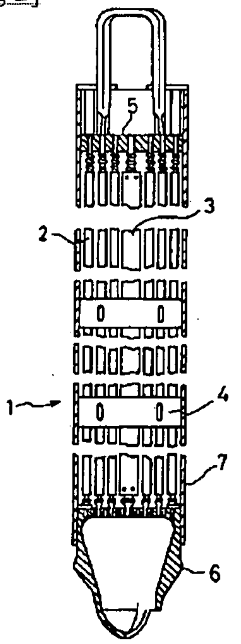
DRAWINGS

[Drawing 1]



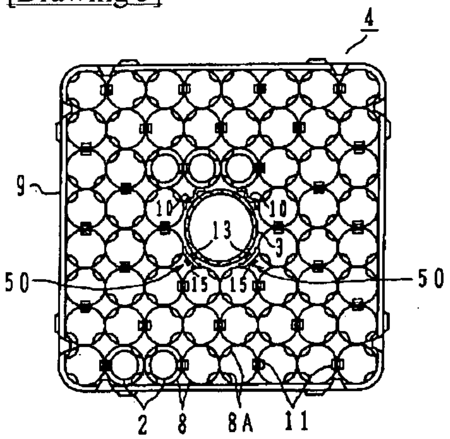
8：丸セル
13：ばね材
13A：プレート接触部
13B：水ロッド押圧部
15：弾性支持プレート
15L, 15R：折曲げ側面
16L, 16R：開口部

[Drawing 2]



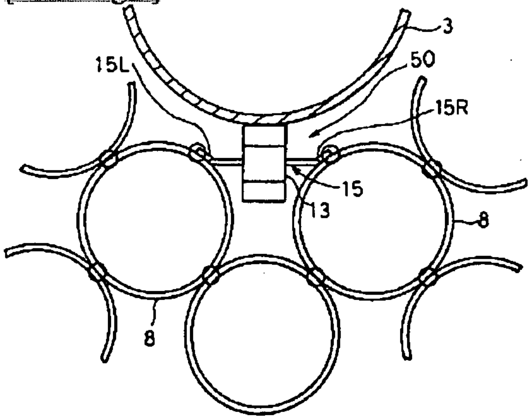
1：燃料集合体
2：燃料要素
3：水ロッド
4：燃料スペーサ

[Drawing 3]

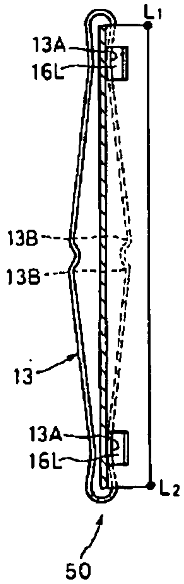


10：固定支持プレート

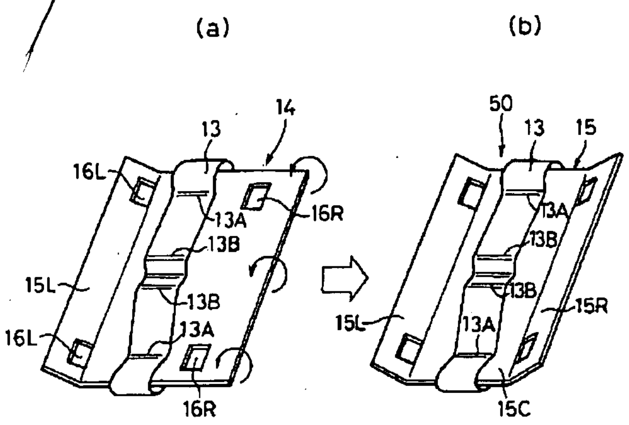
[Drawing 4]



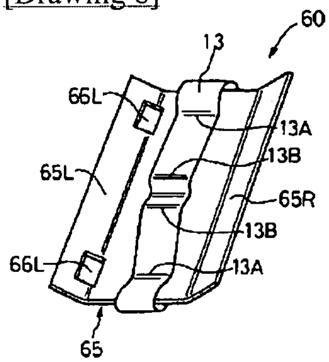
[Drawing 5]



[Drawing 6]

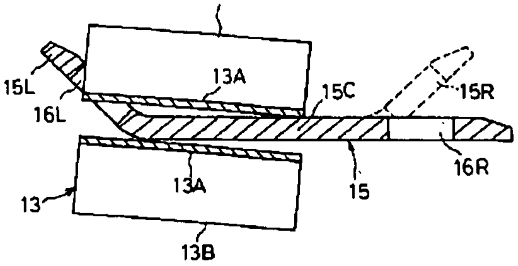


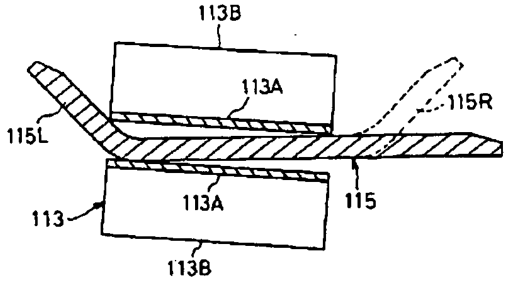
[Drawing 8]



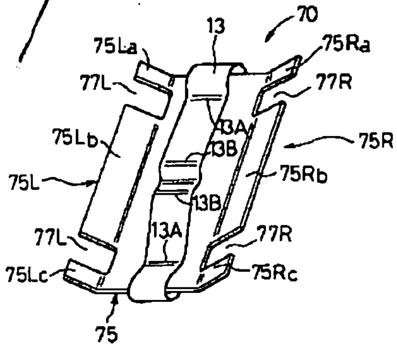
65：弾性支持プレート
65L, 65R：折曲げ側面
66L：開口部

[Drawing 7]



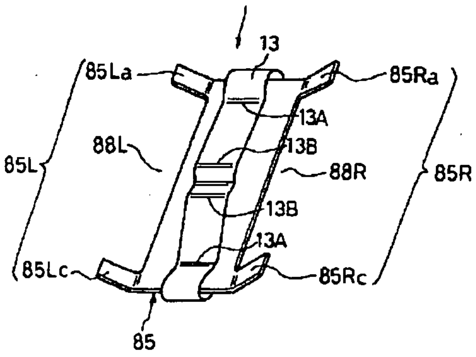


[Drawing 9]



７５：弾性支持プレート
７５Ｌ，７５Ｒ：折曲げ側面
７７Ｌ，７７Ｒ：切欠き部

[Drawing 10]



８５：弾性支持プレート
８５Ｌ，８５Ｒ：折曲げ側面
８８Ｌ，８８Ｒ：切欠き部

[Translation done.]